

1. A6 (Requirements Phase)

- **Overview Statement**

The purpose of this project is to bin count spectrum according to the specified time and energy binning schemes.

- **Goals**

These include:

- Binning count spectrum
- Binning background spectrum (optional, mission specific)
- Create time bins
- Store time bins for future use by this tool

- **System Functions**

- **Input Parameters**

| | |
|------|--|
| R1.1 | Get input parameters for the program such as name of event data file, and names of algorithms for time/energy bin calculations |
|------|--|

- **Read Data**

| | |
|------|----------------------------------|
| R2.1 | Read Events data |
| R2.2 | Read Background data (if needed) |

- **Time Bin Creation**

| | |
|------|--|
| R3.1 | Use specified algorithm to calculate time bins |
| R3.2 | If requested, write time bins to a FITS file for future use by this tool |

- **Energy Bin Creation**

| | |
|------|--|
| R4.1 | Use specified algorithm to calculate energy bins |
|------|--|

- **Bin Data**

| | |
|------|---|
| R5.1 | Use time and energy bins to create binned count spectrum and statistical errors |
|------|---|

- **Store Binned Data**

| | |
|------|--|
| R6.1 | Create a FITS file |
| R6.2 | Create two binary extensions SPECTRUM and EBOUNDS |
| R6.3 | Write binned data to SPECTRUM and energy bin boundaries to EBOUNDS extension |

High Level Use Case

Use Case: Read Data
Actors: FITS file, data
Description: The system opens event data file, and reads TELESCOP keyword to determine the name of the mission. It reads data and keywords for the specific mission. If needed, it opens the background file and reads background data. It ends by closing the files.
References: R1.1, R2.1, R2.2.

Expanded Use Case

Typical Course of Events

| | Actor Action | | System Response |
|---|---|---|--|
| 1 | This use case begins when a request is made to read data. | 2 | Opens the event data file. |
| 3 | Function queries for the mission type. | 4 | Reads TELESCOP keyword to determine the mission name. |
| 5 | Function tests for the mission type to read appropriate data. | 6 | Reads TIME, ENERGY and WEIGHT for SWIFT data. Reads TIME and ENERGY for LAT/GBM data. |
| | | 7 | Reads appropriate keywords. |
| | | 8 | Opens and reads background data file for GBM data. |
| | | 9 | Closes the file. |

Alternative Courses

- Line 1: The file cannot be opened. Indicate error.
- Line 5: Mission is not supported. Indicate error.
- Line 6: Error occurs while reading data. Indicate error.
- Line 7: Error occurs while reading data. Indicate error.
- Line 8: Error occurs while reading data. Indicate error.

High Level Use Case

Use Case: Create Time Bins

Actors: GUI, FITS file

Description: The system checks the algorithm name and queries user for the appropriate parameters. It may also need the energy binning information to determine the time bins. It calculates the time bins and if requested, writes the bins to a FITS file for future use.

References: R1.1, R3.1, R3.2.

Expanded Use Case

Typical Course of Events

| | Actor Action | | System Response |
|---|---|---|--|
| 1 | This use case begins when a request is made to calculate the time bins. | 2 | Checks the name of the algorithm to use. |
| | | 3 | Invokes the appropriate algorithm and queries user for input parameters. |
| | | 4 | Calculates the time bins |
| | | 5 | If requested, Writes the time bins to a FITS file |

Alternative Courses

- Line 2: The algorithm name is invalid. Indicate error.
- Line 3: The input parameters are invalid. Indicate error.
- Line 6: Error occurs while writing data to a FITS file. Indicate error.

High Level Use Case

Use Case: Create Energy Bins
Actors: FITS file, energy bins
Description: The system checks the algorithm name and queries user for the appropriate parameters. It uses the algorithm to calculate the energy bins.
References: R1.1, R4.1.

Expanded Use Case

| | Actor Action | | System Response |
|---|---|---|--|
| 1 | This use case begins when a request is made to calculate the energy bins. | 2 | Checks the name of the algorithm to use. |
| | | 3 | Invokes the appropriate algorithm and queries user for input parameters. |
| | | 4 | Calculates the energy bins |

Alternative Courses

- Line 2: The algorithm name is invalid. Indicate error.
- Line 3: The input parameters are invalid. Indicate error.

High Level Use Case

Use Case: Bin Data
Actors: FITS file, time bins, energy bins, data
Description: The system uses time and energy binning specifications to bin data.
References: R5.1.

Expanded Use Case

| | Actor Action | | System Response |
|---|--|---|--|
| 1 | This use case begins when a request is made to bin data. | 2 | Bins data according to the time and energy specifications. |

Alternative Courses

- Line 2: Data is outside of specified ranges. Indicate error.

High Level Use Case

Use Case: Store Binned Data
Actors: FITS file, binned data
Description: The system creates a new FITS file and writes binned data and relevant information to it.
References: R6.1, R6.2, R6.3.

Expanded Use Case

| | Actor Action | | System Response |
|---|--|---|--|
| 1 | This use case begins when data has been binned and it is requested to be stored. | 2 | Creates FITS file. |
| | | 3 | Creates SPECTRUM and EBOUNDS extensions. |
| | | 4 | Writes binned data to SPECTRUM. |
| | | 5 | Writes relevant keywords to SPECTRUM. |
| | | 6 | Writes energy bin boundaries to EBOUNDS extension. |
| | | 7 | Writes relevant keywords to EBOUNDS. |
| | | 8 | Closes FITS file. |

Alternative Courses

- Line 2: Cannot create file. Indicate error.
- Line 3,4,5,6,7: Cannot write. Indicate error.